

REMARKS

By the foregoing Amendment, Claims 16-27 and 38 have been canceled, and Claims 28, 30, 32, 33, 35, 36 and 43 have been amended. Favorable reconsideration of the application is respectfully requested.

Claims 16-25, 27-43, and 45-46 were rejected as being obvious from Offill, in view of Rosemund et al. and Muller et al. Claims 16-25 and 27 are now canceled, and Claims 28 and 36 have been amended. Claim 28 has been amended to recite "a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000," and Claim 36 has similarly been amended to recite "impregnating a face of a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000 with a reactive resin that chemically bonds with a curing agent." Offill discloses a flexible liner forming a mechanical lock rather than bonding with a carrier material, as is discussed at column 7, lines 13-20, "so that the flexible liner can remain flexible with respect to and independent from the adjacent wall surface." The use of the flexible liner requires the use of a collapsible, traveling form 42, with a piston 47 and arms 48 and 50 to support the flexible liner while the carrier material is injected over it. It is respectfully submitted that Offill

does not teach or disclose the use of a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000, and no motivation is provided in Offill for the use of such a sheet of high tensile strength rigid polyvinyl chloride material. Support for the limitation of the flexural modulus of approximately 350,000 to 650,000 can be found in the specification at page 14, lines 9-10, and support for the rigid nature of the sheet of polyvinyl chloride material can be found at page 8, lines 7-9, and page 12, lines 21-23. Further objective support for the rigid nature of the sheet polyvinyl chloride material is shown in the attached excerpt from Modern Plastics Encyclopedia 1984-1985, pages 480 and 481, in which polyvinyl chloride with a flexural modulus of 300,000 to 500,000 is categorized as being "rigid." It is respectfully submitted that Rosemund et al. and Muller et al. also do not teach, disclose, suggest or provide motivation for the use of a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000, either separately or in combination with Offill.

Claims 26 and 44 were also rejected as being obvious from Offill, in view of Rosemund et al., Muller et al. , and Ranney et al. Claim 26 has been canceled, and it is respectfully submitted that Ranney et al., either separately or in combination with the other references, also does not teach teach, disclose, suggest or provide motivation for the

use of a sheet of high tensile strength rigid polyvinyl chloride material having a flexural modulus of approximately 350,000 to 650,000 as is claimed.

It is respectfully submitted that the structural reinforcement provided by the sheet of rigid polyvinyl chloride material provides unexpected benefits of allowing the liner to be not only self-supporting but also to support the thermosetting material during installation, and to support the completed structure in a manner not suggested or taught in the references cited. It is therefore respectfully submitted that the rejections of the claims on the grounds of obviousness should be withdrawn in view of the claims as now amended.

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In light of the foregoing, it is respectfully submitted that the application should now be in a condition for allowance, and an early favorable action in this regard is respectfully requested.

Respectfully submitted,

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DGP/rvw

Encls.: Return Postcard

Excerpt, Modern Plastics Encyclopedia 1984-1985, pages 480 and 481 ✓

Version With Markings To Show Changes Made

Request for Three-Month Extension

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## VERSION WITH MARKINGS TO SHOW CHANGES MADE

**IN THE CLAIMS:**

28. (Twice amended) A load bearing structure having a closed-loop configuration in cross-section defining a predetermined interior, comprising an integrated, chemically continuous composite material having a plurality of regions continuing progressively from an outside of said structure to said interior of said structure, said composite material comprising:

5 structure, said composite material comprising:

- a. a first compositional region comprising a porous, mineral-containing substrate having pores;

b. a second compositional region comprising a thermoset material

chemically bonded by silane to, and intermixed with at least some of the mineral and within said pores of said substrate to form a matrix;

10 within said pores of said substrate to form a matrix;

c. a third compositional region proximate and interphased with said second compositional region consisting of a thermoset material selected from the group

<sup>1</sup> See also the discussion of the relationship between the two in the introduction to this volume.

15 and consisting of polyvinyl chloride having a substantial amount of hydroxyl ions  
molecularly bonded to some isocyanates; and

e. a sheet of high tensile strength rigid polyvinyl chloride [thermoplastic]  
material having a flexural modulus of approximately 350,000 to 650,000 proximate to  
and defining said predetermined interior having a predetermined boundary and a  
20 predetermined interior dimensions, said high tensile strength rigid polyvinyl chloride  
[thermoplastic] material sheet having a tensile strength of at least 2200 pounds per square  
inch, wherein said high tensile strength rigid polyvinyl chloride [thermoplastic] material  
and thermoset material are bonded together and to said substrate with sufficient shear  
strength to transmit and distribute loads on said substrate to said high tensile strength  
25 rigid polyvinyl chloride [thermoplastic] material to improve the structural load bearing  
strength of said load bearing structure.

30. (Amended) The load bearing [integrated composite] structure of  
Claim 28 in which the rigid polyvinyl chloride material has [thermoplastic material sheet  
is polyvinyl chloride having] a tensile strength in the range of from 5,000 psi to 10,000  
psi.

5

32. (Amended) The load bearing structure of Claim 28 wherein said first face of said rigid polyvinyl chloride [thermoplastic] material sheet has a surface area, and wherein said integrated composite material further comprises means positioned on said first face of said rigid polyvinyl chloride [thermoplastic] material sheet for increasing the surface area of said first face.

33. (Amended) The load bearing structure of Claim 32 wherein said means for increasing said surface area of said first face comprises ridges raised from said first face, comprising surface areas generally perpendicular to said rigid polyvinyl chloride [thermoplastic] material sheet.

35. (Amended) The load bearing structure of Claim 33 [34] wherein said raised ridges are positioned circumferentially in relation to said conduit.

36. (Twice amended) A method for lining a conduit having a porous substrate surface, the method comprising the steps of:

impregnating a face of a sheet of high tensile strength rigid polyvinyl chloride [semi-rigid thermoplastic] material having a flexural modulus of approximately

5        350,000 to 650,000 with a reactive resin that chemically bonds with a curing agent; positioning said sheet of high tensile strength rigid polyvinyl chloride [semi-rigid thermoplastic] material within the interior of said conduit spaced apart from said substrate surface to create a space between said rigid polyvinyl chloride [semi-rigid thermoplastic] material sheet and said substrate surface;

10            inserting a mixture of a thermosetting material and said curing agent within said space; and

                  allowing said thermosetting material to bond with said substrate surface, and allowing said face of said rigid polyvinyl chloride [thermoplastic] material to chemically bond with said curing agent of said thermosetting material, wherein said rigid polyvinyl chloride [thermoplastic] material and thermosetting material are bonded together and to said substrate surface with sufficient shear strength to transmit and distribute loads on said substrate surface to said high tensile strength rigid polyvinyl chloride [semi-rigid thermoplastic] material to reinforce said conduit.

43. (Amended) The method of Claim 36, further comprising the step of forming raised ridges on said face of said rigid polyvinyl chloride [thermoplastic] material to increase the surface area of said face.

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Materials	Properties	ASTM test method	Block copolymer of styrene and ethylene or butylene	Thermoplastic elastomer (Cont'd)							Ure Alpha cellul filled										
				Polyurethane																	
				Solution coating resins		Molding and extrusion compounds															
				Polyester		Polyester		Polyether													
				Low and medium hardness		High hardness		Low and medium hardness		High hardness											
Processing	1. Melting temperature, °C. T <sub>m</sub> (crystalline) T <sub>g</sub> (amorphous)																				
	2. Processing temperature range, °F. (C = compression; T = transfer; I = injection; E = extrusion)		C: 300-380 T: 350-480 E: 330-380	- 20 to + 16	- 49	120-160	120-160	120-160	120-160	120-160											
	3. Molding pressure range, 10 <sup>3</sup> p.s.i.		1.5-20			0.8-1.4	0.8-1.4	0.6-1.2	1-1.4												
	4. Compression ratio		2.5-5.0																		
	5. Mold (linear) shrinkage, in./in.	D955	0.006-0.022			0.008-0.015	0.005-0.015	0.008-0.015	0.008-0.012												
Mechanical	6. Tensile strength at break, p.s.i.	D638 <sup>b</sup>	1000-3000	4500-7900	5500	3300-8400	4000-11,000	1500-6750	6000-7240												
	7. Elongation at break, %	D638 <sup>b</sup>	600-850	290-630	530	410-620	110-550	475-1000	340-425												
	8. Tensile yield strength, p.s.i.	D638 <sup>b</sup>																			
	9. Compressive strength (rupture or yield), p.s.i.	D695																			
	10. Flexural strength (rupture or yield), p.s.i.	D790																			
	11. Tensile modulus, 10 <sup>3</sup> p.s.i.	D638 <sup>b</sup>		0.33-1.45 <sup>c</sup>	0.7 <sup>c</sup>																
	12. Compressive modulus, 10 <sup>3</sup> p.s.i.	D695																			
	13. Flexural modulus, 10 <sup>3</sup> p.s.i.	73° F. D790 200° F. D790 250° F. D790 300° F. D790	4-100																		
	14. Izod Impact, ft.-lb./in. of notch ( $\frac{1}{8}$ -in. thick specimen)	D256A	No break																		
	15. Hardness	Rockwell D785 Shore/Barcol D2240/ D2583	Shore A50-90 Shore A70-D54			Shore A55-95	Shore D46-78	Shore A70-92	Shore D55-75												
	16. Coef. of linear thermal expansion, 10 <sup>-6</sup> in./in./°C.	D695																			
	17. Deflection temperature under flexure load, °F.	264 p.s.i. D648 66 p.s.i. D648																			
	18. Thermal conductivity, 10 <sup>-4</sup> cal.-cm./ sec.-cm. <sup>2</sup> °C.	C177																			
Physical	19. Specific gravity	D792	0.9-1.2	1.19-1.22	1.11	1.17-1.25	1.15-1.28	1.10-1.20	1.14-1.21												
	20. Water absorption ( $\frac{1}{8}$ -in. thick specimen), %	24 hr. D570 Saturation D570	0.17-0.42				0.3														
	21. Dielectric strength ( $\frac{1}{8}$ -in. thick specimen), short time, v./mil	D149						470	470												
Design and performance properties		SUPPLIERS <sup>a</sup>	Concepc1 Polymer; Dow Chem.	Goodrich	Goodrich	Upjohn; Daihpon; Goodrich; Mobay; Ohio Rubber	Upjohn; Goodrich; Mobay; Ohio Rubber	Upjohn; Goodrich; Mobay; Ohio Rubber	Upjohn; Goodrich; Mobay; Ohio Rubber	Upjohn; Goodrich; Mobay; Ohio Rubber	Am. Cyanamic Budd; MKB; Patent Plastics Perstorp										
For more detailed information on performance and design properties of plastics by trade name and grade, see the following charts:																					
Chemical resistance .....																					
Dimensional stability .....																					
Electromagnetic shielding .....																					
Environmental stress-crack resistance .....																					
Fatigue .....																					
Optical properties .....																					
In the 1983-1984 edition of MPE, see:																					
Creep .....																					
Dielectric loss properties .....																					
Films .....																					
Foams .....																					
Impact resistance .....																					
Laminates, by NEMA grades .....																					
Outdoor exposure resistance .....																					
Poisson's ratio .....																					
In the 1981-1982 edition of MPE, see:																					
Flammability .....																					
Pipe .....																					
In the 1980-1981 edition of MPE, see:																					
Specifications/materials .....																					
Temperature index .....																					

e—Boldface listings identify advertisers in this issue. Where advertisements relate to the particular materials described, reference to the page number is included. See the Directory of Suppliers Classified Index, page 708, for additional suppliers of specialty materials and custom compounds.

b—Tensile test method varies with material: D638 is standard for thermoplastics; D612 for rigid thermosetting plastics; D412 for elastomeric plastics; D882 for thin plastic sheeting.

c—Secant modulus at 100% elongation.

ECONOMY BOOK

### Vinyl polymers and copolymers

Urea		Molding and extrusion compounds									
		Polyvinyl chloride and polyvinyl chloride-acetate molding compounds, sheets, rods, and tubes			Vinyl formal		Chlorinated polyvinyl chloride		Vinyl butyral, flexible		PVC/acrylic blends
Alpha cellulose-filled	PVC molding compound, 15% glass fiber-reinforced	Rigid	Flexible, unfilled	Flexible, filled	Vinyl formal	Chlorinated polyvinyl chloride	Vinyl butyral, flexible	PVC/acrylic blends			
1. Thermoset											
	75-105	75-105	75-105	75-105	105	110	49				
2. C: 275-350 I: 290-320 T: 270-300	I: 270-405	C: 285-400 I: 300-415	C: 285-350 I: 320-385	C: 300-350 I: 300-400	C: 350-400 I: 395-440 E: 360-415	C: 280-320 I: 250-340	I: 360-390 E: 390-410				
3. 2-20	8-25	10-40	8-25	1-2	10-30	15-40	0.5-3	2-3			
4. 2.2-3.0	1.6-2.2	2.0-2.3	2.0-2.3	2.0-2.3		1.5-2.5		2-2.5			
5. 0.006-0.014	0.001	0.002-0.006	0.010-0.050	0.008-0.035 0.002-0.008(trans.)	0.001-0.003	0.003-0.007		0.003			
6. 5500-13,000	9500	5900-7500	1500-3500	1000-3500	10,000-12,000	6800-9000	500-3000	6400-7000			
7. <1	2-3	40-60	200-450	200-400	5-20	4-65	150-450	35-100			
8. 5900-6500						6000-8000					
9. 25,000-45,000	9000	8000-13,000	900-1700	1000-1800		9000-22,000		6800-8500			
10. 10,000-18,000	13,500	10,000-16,000			17,000-18,000	14,500-17,000		10,300-11,000			
11. 1000-1500	870	350-600			350-600	341-475		340-370			
12. 1300-1600	750	300-500				335-600					
13. 22-36						380-450		350-380			
14. 0.25-0.40	1.0	0.4-22	Varies over wide range	Varies over wide range	0.8-1.4	1.0-5.6	Varies over wide range	1-12			
15. M110-120	R118				M85	R117-122	A10-100	R106-110			
		Shore D65-85	Shore A50-100	Shore A50-100							
16. 260-290	155	140-170			150-170	202-234		167-185			
	165	135-180				215-247		172-189			
17. 7-10		3.5-5.0	3-4	3-4	3.7	3.3					
18. 1.47-1.52	1.54	1.30-1.58	1.16-1.35	1.3-1.7	1.2-1.4	1.49-1.58	1.05	1.26-1.35			
19. 0.4-0.8	0.01	0.04-0.4	0.15-0.75	0.5-1.0	0.5-3.0	0.02-0.15	1.0-2.0	0.09-0.18			
20. 300-400	600-800	350-500	300-400	250-300	490		350	480			
21. Am. Cyanamid; Budd; MKB; Patent Plastics; Perstorp	LNP; Thermofil	Alpha Chem. (see ad, p. 95); Occidental; Union Carbide; Air Products; Borden; Colorite; Conoco; Georgia-Pec.; Goodrich; Goodyear; Keyser-Century; Novatec; Pentose; Steuffer; Tenneco	Alpha Chem. (see ad, p. 95); Occidental; Union Carbide; Air Products; Borden; Colorite; Conoco; Georgia-Pec.; Goodrich; Goodyear; Keyser-Century; Pentasote; Steuffer; Tenneco	Alpha Chem. (see ad, p. 95); Occidental; Union Carbide; Air Products; Borden; Colorite; Conoco; Georgia-Pec.; Goodrich; Keyser-Century; Pentasote; Steuffer; Tenneco	Monsanto	Goodrich	Union Carbide; Monsanto	Sumitomo (see ad, p. 91)			

or thermoplastics: D651  
D882 for thin plastic